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A developmental setting for multi-handicapped preschool children and the physical layout of the classroom are described. Photographs and drawings of specially designed educational equipment, such as a shallow sand and water table adapted for wheelchair-bound children and an adjustable easel that allows armless children to paint with their feet, show the use of the materials and their design construction. Commentary is included which describes the function and purpose of each learning material along with the history of the school, its medical setting, and the educational philosophy of the program. (WW)

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REHABILITATION MONOGRAPH XXXIX

The Design of A Pre-School "Learning Laboratory" in a Rehabilitation Center

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INSTITUTE OF REHABILITATION MEDICINE
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by RONNIE GORDON

DIRECTOR — KATHERINE LILLY CONROY PRE-SCHOOL
DEVELOPMENTAL PROGRAM

FOREWORD

The Katherine Lilly Conroy Learning Laboratory didn't just happen. The idea was born in the sensitive mind of Mrs. Katherine Conroy years ago. In fact, her father, Mr. Evan F. Lilly to whom the pediatric research wing is dedicated, was definitely involved in the genesis of the idea. He taught Mrs. Conroy, even as a child, something of the spiritual, emotional and educational needs of crippled children. It is indeed remarkable that a man, who died in 1903, could have had such an advanced concept of physical rehabilitation.

Mrs. Conroy's interest started at the Institute some 15 years ago when she made possible a special therapeutic area in Physical Therapy to further the physical development of our severely disabled children.

It was soon recognized that this was not enough. Far too little was known of the emotional and educational needs of these children and we had meager knowledge to meet them.

Seven years ago a new partnership was formed - Mrs. Conroy and Miss Jessie Stanton (who had dedicated her life to the education of young children). They were joined by Mrs. Ronnie Gordon, director of the developmental program, who was also infected with the obsession to do something for severely disabled youngsters to close the communication gap.

An educational program was initiated based on sound developmental theory, modified and adapted to meet the needs of handi-

capped children and staffed by skilled and dedicated teachers. More recently a physical environment was designed to increase the ability of these children to function in an educational situation. "The Learning Laboratory" is the end result; an oasis of new approaches to bridge the hiatus that has existed in this barren desert of mediocrity. Today this oasis provides a learning experience, not only for the children and their parents, but for their teachers and our staff - and the hundreds of visitors that come to watch this metamorphosis through the one-way glass partition. New horizons that develop each day are broader and brighter and more hopeful.

In this laboratory where there are no test tubes, or microscopes or the usual laboratory paraphernalia, new, more sensitive and more precise methods of understanding are developing that will be a new language of human understanding.

In behalf of all of my co-workers at the Institute and for the countless children that in the future will benefit from the program in the years to come, we express our heartfelt gratitude. We are grateful to Mrs. Conroy, Miss Stanton and Mrs. Gordon for giving us these new opportunities and the new precision tools heretofore non-existent. We have been given the tools and the challenge. We accept and dedicate ourselves to this cause.

HOWARD A. RUSK, M.D.

The Katherine Lilly Conroy
Pre-School Developmental Program

History of Project -

For the past seven years, the Institute of Rehabilitation Medicine of New York University Medical Center has operated a school for the pre-school aged children who are admitted to the Institute as in-patients for differential diagnosis, evaluation, and/or medical and para medical therapy.

An integral part of the Institute since 1962, this school grew out of a one year grant and experiment to create a "caring situation" for the youngest in-patients. It now has added an out-patient population and has four main responsibilities:

1. To stimulate the intellectual, social, and emotional growth of the children serviced on the children's division of the Rehabilitation center.

2. To provide all medical and para medical professional personnel* with an opportunity for acquiring realistic ideas of how the young child's adaptive and cognitive powers grow and function in a naturalistic setting.

3. To compare the intellectual and behavioral responses of handicapped pre-school children with those of normal children with age-appropriate educational materials.

4. To isolate and evaluate learning disabilities in handicapped youngsters and to attempt to initiate therapeutic measures in the pre-school period.

When the school was first conceived in 1961, we were concerned about the modifications that would have to be made in

*The disciplines represented on the children's service include pediatritions, physiatrists, psychiatrists, psychologists, educators, social workers, nurses and speech, physical and occupational therapists.

educational philosophy, procedures, methods, materials, and curriculum to incorporate a school into a rehabilitation framework. We recognized immediately that each child's program would have to fit in with appointments for therapy, and, therefore, that each program would have to be non-continuous and different. At times we questioned the possibility of effectively servicing a constantly changing class of children of different chronological and mental ages, varying basic and manifest endowment and experience, whose development was impaired or interrupted in many different ways. The neuro-motor and muscle-skeletal disabilities of our children have ranged from minor to severe and their intelligence, psychometrically, varied from grossly defective to superior.

The school, which began in the children's dining-room, as an adjunct to the children's medical and training program, now has its own specially designed quarters and equipment as a "Laboratory for the Study of Learning Dysfunction" and is recognized as an integral part of the rehabilitative service in the Institute's new research wing. Educational therapy periods are prescribed by the psychiatrists as part of the youngster's rehabilitation program. Educational assessment, on a developmental scale, is a routine part of the weekly interdisciplinary evaluation conferences.

One might appropriately describe this new physical environment as custom-designed and adapted to meet the developmental needs of normal children as well as the peculiar needs of the atypical children of our Rehabilitation Center. This enables us to explore in depth the modifications in physical setting and curriculum planned for children with unusual problems. These exceptional children - or as we prefer to regard them, as children with an exceptional burden of difficulties - are first and foremost children. They respond and have the needs of normal children with the usual share of problems - those problems that are implicit in just growing up. We feel that in handicapped children these needs are intensified - are quantitatively greater but qualitatively very similar to normal children in this particular age group.

A logical approach, therefore, suggests that first we talk about the areas of interest and the areas of curriculum in a sound Nursery School or pre-school program for normal children. And then, we can attempt to identify those modifications and adaptations in the physical setting that had to be made to facilitate the play of

abnormal children in these particular areas with similar curricular goals. The objectives and goals of a pre-school program, as reflected in the design of a curriculum should be analyzed in terms of differences that are suggested in a school for exceptional children in contrast to the more conventional objectives and goals in neighborhood nursery schools and day care centers for children of this age group.

Educational Philosophy of a Pre-School Program

Within recent years it has been recognized and accepted by professionals from the many disciplines involved in the early years of childhood, that these are most critical and vulnerable years. These are the years during which a child accumulates a reservoir of information, a pattern of behavior, and a good deal of his particular individuality of personality. The beginnings of motivation are established, and attitudes are developed toward learning and toward himself as a learner well before the age of six. Much of the learning of the very young child is a by-product of individual investigation and exploration; such learning is suggested by the child's immediate physical environment and the materials and activities available to him.

A pre-school program should operate on the theory that a child can be helped to grow intellectually, socially and emotionally in a warm and stimulating environment - one in which he is free to express his feelings and one which offers him opportunities to accomplish and experience pleasure and success. In philosophy then, our conception of a sound program of play varies little from the conventional pre-school nursery school.

We can not afford to neglect the critical and basic role of play in maturation and development. Just as the normal child is offered intensive exposure to sensory, art, relationship, language and music experiences so are our patients in the Learning Laboratory. Our children are offered first:

1. Sensory experiences with water, sand and finger paints.
2. Creative art activities with a variety of media.

3. Experiences with relationship and constructural materials; e.g. blocks, puzzles and a variety of manipulative toys - to help them develop ideas of space, organization and association.

4. An opportunity through dramatic play - to relearn and recreate home and hospital experiences and to simultaneously release feelings about these experiences.

5. An introduction to the physical world through simple experiments with water pressure, levels, magnetisim, floatation etc.

Secondly, we offer them encouragement constantly in the use of expressive language as a means of communication of both feelings and ideation. Thirdly, the children are exposed to music and literature - carefully selected for being both stimulating and meaningful at their age. And last - and perhaps most imperative - they have the opportunity to be with other children - to learn the gratification of being part of a group and at the same time the controls required of a group member. "Research on development confirms the importance of peer interaction. Failure to play may contribute to continuing dependency, failure of individuation and inability to form emotional ties to others." (Freeman, 1967) "The child's self-image is built around the meaning the child has, as an individual, to the adult and his peers." (Biber and Franklin, 1967)

As stated previously, these curricular goals are in a sense traditional ones for a sound developmental program. They are meaningful to and appropriate for all young children and they have been judged to be effective ones to encourage development of the normal child as a learner. Each abnormal child requires a sensitive adjustment and a continuous readjustment of both goals and activities based on his individual strengths and deficits. Children who have a variety of handicaps need many modifications and adaptations in both the activities and the materials offered to them.

In a pre-school program for normal children, large blocks of time are allocated to free-play - which in reality is self-initiated play based on the interest of the child. The choice of an activity is in turn suggested by both the availability and attractiveness of materials and accessories that are on display - on shelves and storage

units that are readily reached by the smallest students. Normal youngsters by 2-2½ years of age have developed sufficient visual and motor competence to examine a room and walk to an individual area or closet that appears inviting. The selected material can be carried to any appropriate work surface or floor area by the child before he proceeds with his investigation and work. If at that moment, it is a relationship with a person - peer or teacher - that is important to the youngster, he is free to change his position in the room and make a decision or even a tentative movement toward the attracting person or child.

These options and this freedom accepted so casually by our normal population, are curtailed, abridged and often completely removed from the life pattern of a handicapped child. If option and freedom of selection and decision-making are recognized as implicit and necessary to growth and development, arrangements have to be made to provide a facilitating environment for the child who can't readily make the movement, the gesture, the contact, the decision or the choice of an activity. Therefore, in attempting to provide an effective physical environment for educating handicapped pre-school youngsters, the design of the school room itself as well as the furniture and the equipment are of primordial importance for optimal teaching.

The Medical Setting

There were many factors that influenced and affected our initial and final planning - some obvious and some subtle. One determinant in our thinking was the specialized medical setting of the school - and the goals of a rehabilitation center itself - particularly habilitation objectives that are projected for the youngest of in-patients. Another was the unique population serviced on this pediatric rehabilitation service - in terms of the pathologies and the mosaic of handicapping conditions (physical and mental) we attempt to ameliorate in this interdisciplinary setting.

I specifically mention these objectives as "habilitative" because, in a sense, they are different from the rehabilitative objectives planned for the adult. An adult's rehabilitation program is oriented toward *returning* the patient to maximum function based on the patient's past intellectual and physical performance - a known quantity in the case of a stroke patient or one whose disability is post-traumatic in origin. In a child, whose handicap is related to congenital disability or dysfunction, our goal is to *raise* the child to a capacity that had never been approached or delineated before.

The design of the school room was strongly influenced by the way in which both the medical and administrative directors of the Institute initially interpreted and later extended the role of this demonstration project in their medically oriented-setting staffed by a multi-disciplinary team. Their objectives can best be recapitulated under four categories:

1. The therapeutic role - to offer the patients a pre-school educational program consisting of appropriate learning and social experiences with exposure to activities and materials the children would have had if they were not handicapped and were not hospitalized.

2. The diagnostic and evaluative role - to afford the medical and para medical staff with an educational assessment and developmental profile of the youngest patients as interpreted by pre-school educators (with particular emphasis on uncommon and deviant patterns of behavior and intellectual functioning in contrast to a normative population).

3. The research role - to provide the population, program, and facilties for investigation of a variety of normal and abnormal learning patterns. An observation room equipped with appropriate audio and visual recording devices is an integral part of the architectural design.

4. The teaching role - to develop a graduate program of internship for training professionally qualified early-childhood teachers of normal children as specialists in the education of multi-handicapped pre-school children.

The Population Serviced

The children who are provided educational evaluation represent the diverse types of physical, mental and behavioral problems commonly seen in pediatric rehabilitation units. Cerebral palsy, acquired and congenital, with its multiple physical, intellectual, communication, behavioral and educational problems is the most prevalent diagnosis.

In recent years we have become more frequently involved with children with minimal motor deficits of neurological origin but with behavioral and perceptual problems which may be predictors of learning dysfunction. Another new group of youngsters, the etiology of whose handicap can be traced to maternal rubella, present as unusual combination of motor and sensory deficits.

The Institute's intensive clinical program for children with spina bifida associated with myelomenigocele has enabled us to study the learning problems of children with hydrocephalus. The out-patient program of the pediatric rehabilitation service refers children with progressive muscular dystrophy, infantile atrophy and children with a profound variety of limb deformities. In addition to these major categories of handicapping conditions, there are children with uncommon types of birth defects and diseases of the musculoskeletal system.

Knowledge of the medical diagnosis and neuro-motor deviations of this very specialized population is necessary if one is to be effective in minimizing the influence of physiological differences as depressors of performance in a learning situation.

Familiarity with the many types of cerebral dysfunctions that interfere with, restrict or limit intellectual development as sequelae to an insult to the central nervous system enables the teacher to be sensitive to each child's cognitive capacities and validly assess and plan purposefully each young patient's very individualized educational program.

Basic Design

Over-View of the Schoolroom

The overall arrangement and dimensions of the room could only be established after the areas of activites and curriculum were clearly delineated with their corresponding work-surface clearly defined both in size, shape and position within the schoolroom. (FigureI) A sensitive evaluation had to be made of the movement of children on crutches, in wheelchairs, in stryker frames and stretcher beds in order to gauge the amount of traffic and space required for movement in and out of the schoolroom and from one particular activity area to another. Judgments had to be made about placement of each activity in relation to another and different type of activity (e.g. "quiet" vs. "noisy" areas, group vs. private areas). Only then could the framework and closet space, the walls and storage positioning be determined.

The Size of the Room

The minimal requirement for free movement of two by-passing wheelchairs from one space to another between each piece of designed equipment and the relative placement of each of these very individualized work surface suggested an overall dimension of 40x20 feet for the rectangular schoolroom proper - allowing footage on either side of the longer dimension for storage units.

Delineation of Storage Areas

Units Accessable to Adults

All 40 feet of one wall with the exception of the 4 feet for the children's entrance into the Nursery Schoolroom were designated as adult storage and utility space. All closets, from floor

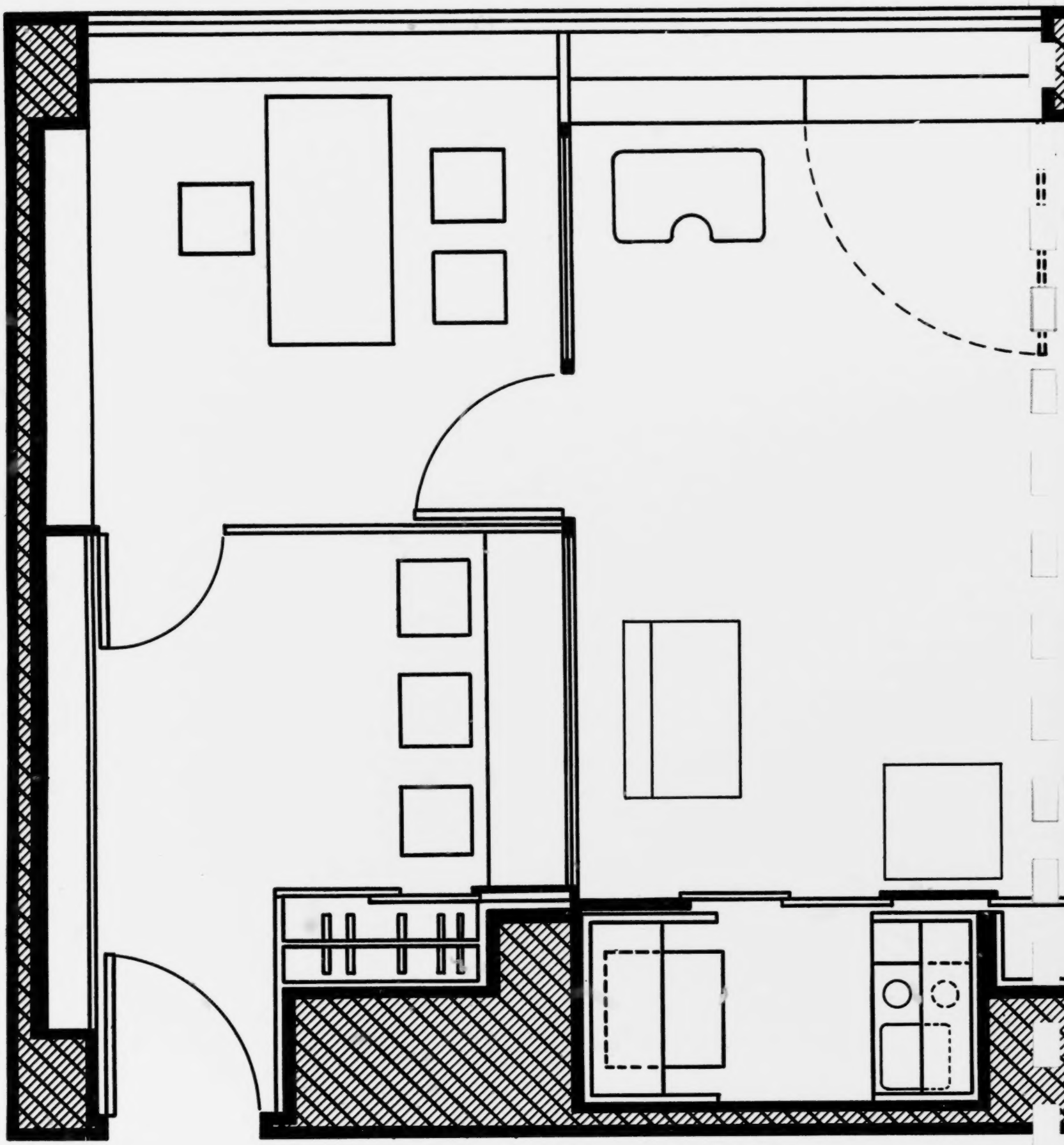
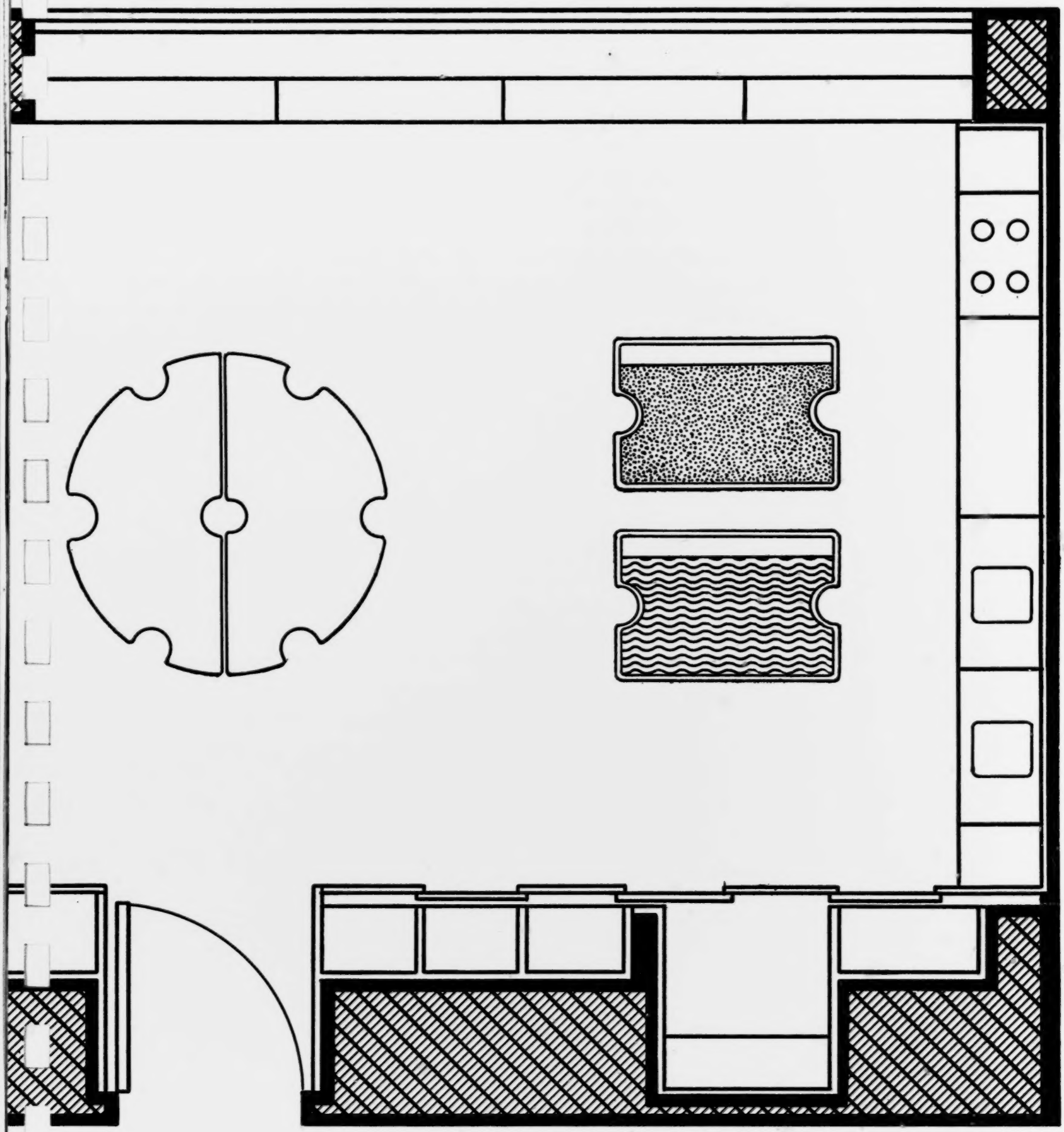


Figure 1

Over-View of the Learning Laboratory



The related positions of 1. the Schoolroom, 2. the Observation Room, 3. the Director's Office.

to ceiling, were closed by series of wooden sliding doors on double track. Each particular grouping of sliding doors was designated for the activity space adjacent to it - with appropriate modifications in shelves to best service the types of materials used to complement the play in that area. Allowance was made in the most rear closet for a series of individual "lockers" to hold the outer clothing and personal possessions of our out-patient research group of children. To the right of that, is a large enclosure planned to hold over-sized pieces of play equipment (the rocking-boat, doll carriage, reserved supplies of sand, peg-board holders for crutches and arms of wheelchairs, etc.). Shelves were spaced to hold all of the materials that supplement sand and water play - the two tactile activities assigned to this area.

A more shallow closet, aligned with the main tables, was fitted with a custom-designed unit composed of an aluminum frame that enclosed five tiers of plastic containers varying in depth and width. This stores a large assortment of developmental, manipulative, and constructional educational materials that are used in this play area. This design, with transparent lucite boxes, has proven to be a most propitious one. Each material has its own place and container. The teacher has the correct and sought for material at her "finger tips" within moments after a decision has been made as to a new or comparable activity or task to follow. In an intensive educational therapy setting, it is obvious that timing and time itself are both basic to an effective work program. With this unique storage unit the clarity of organization has proven to be one of the most successful innovations.

On the other side of the door-way (that leads into the school) are units designated for the accommodation of other materials that encourage discriminatory abilities - tasks that demand shape, form, size, and color differentiation.

The area behind the last two doors of the schoolroom is devoted to a wide walk-in closet - equipped for the teacher's use with a combination of stove, sink and refrigerator as well as storage space for a second easel and all of the materials (paints, brushes, paste, paper, clay etc.) that are used with art activities.

Units Accessable to Children

The Window-Unit

Parallel to the adult storage space, along the 40 feet of window wall, low shelving was planned at a height appropriate for small children (those who can ambulate and also those who are wheelchair bound). Only two horizontal shelves were planned - each 12" in height. Our intent in this area was to place the manipulative materials that would be used most actively by the current census. None of the 6 storage units was to hold more than 3 educational toys. Clarity in presentation was our purpose.

The doors that enclosed these window-units were custom-designed. Traditional doors – ones that open on outward hinges, or ones that raise or slide – were known by experience to be inadequate to the peculiar needs of our children. Youngsters, braced and on crutches, can not back-up to open a conventional door. Children in wheelchairs are restricted in the same movements. Tambour type doors that fold away into a planned recessed area were therefore incorporated into our treatment. We used leather handles both to facilitate grip and to prevent the children's contact with hard objects.

The top-most expanse of these low storage units was faced with formica to encourage the use of this readily-cleaned area as an added work space.

The Hand-Rail

A metal hand-rail, 3/4 of an inch in diameter, (the proportion based on estimates of the average young child's hand size) was attached to the top shelves of the window storage unit - extending the length of the room. This was designed to facilitate the children's safe access to the equipment, recognizing that a child on crutches or a child who is just beginning to ambulate would be more comfortable, more self-initiating in his play and more encouraged to make his own selection of materials with the help and security provided by this type of hand-rail.

The Housekeeping Unit

In pre-school programs for normal children there is traditionally a corner designated for housekeeping and dramatic play. A corner concept was felt to be impractical for children whose movement requires wide lanes for traffic to and from an activity. Our outline, therefore, called for a horizontal scheme of the components of the more conventional "corner" area - counters and sinks and play stove adjacent to each other at the correct height for children. (Figure 2)

The cooking area was represented by a counter surface supported by two narrow storage closets to hold the accessories to that play. Burners were but sketched outlines suggesting the use of that particular expanse of counter. Rotating knobs were inserted to represent switches. A large expanse of utility space, all finished in formica, separates the "stove" from the two custom-designed functional sinks that were constructed at two different heights based on the two most standardized proportions of wheelchairs used by our population.

We believe that water play is a most basic and therapeutic activity in any program for children of 2-6 years of age. We recognized realistically that children in a rehabilitation setting (many of whom wear metal or prosthetic devices, and many whose mental functioning is not of the level that suggests understanding of causal relationships) would require very individual modifications in this curricular area if it was to be used effectively and safely. (Figure 3 & 4)

Some of the factors that had to be considered in the design of the sinks were:

1. Placement of the sink basin itself in the framework of the formica counter in closest proximity to the child to facilitate the use of this piece of equipment by children with congenital defects in their upper extremities that are manifested by stumps and abortive arms.

2. The drain pipes in the plumbing were recessed to allow for sufficient room for the wheelchairs to be inserted under the sink so that the child would have optimal use of his arms at the correct height for play in the basin itself.

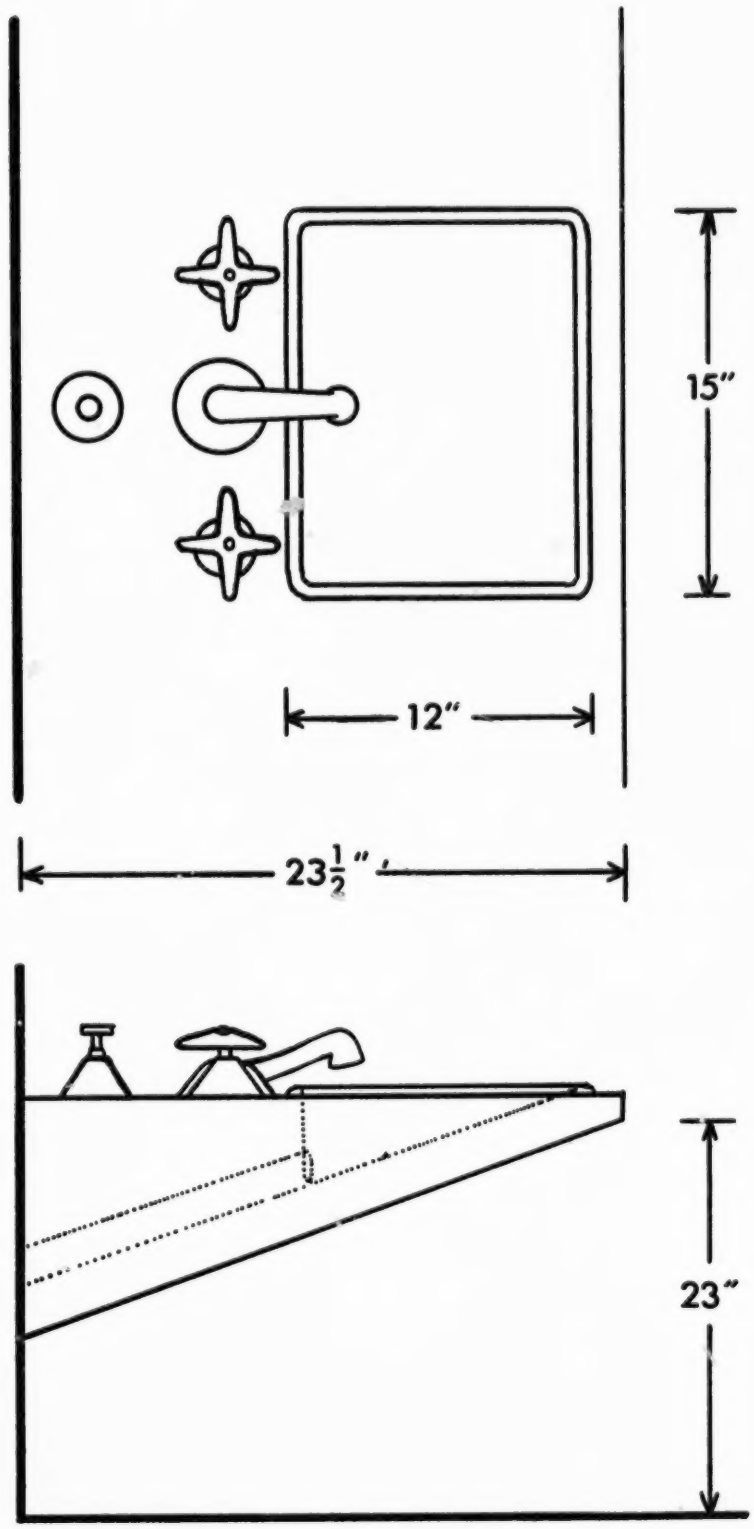


Figure 2

The Design of the Children's Sink in the "Housekeeping" Unit.

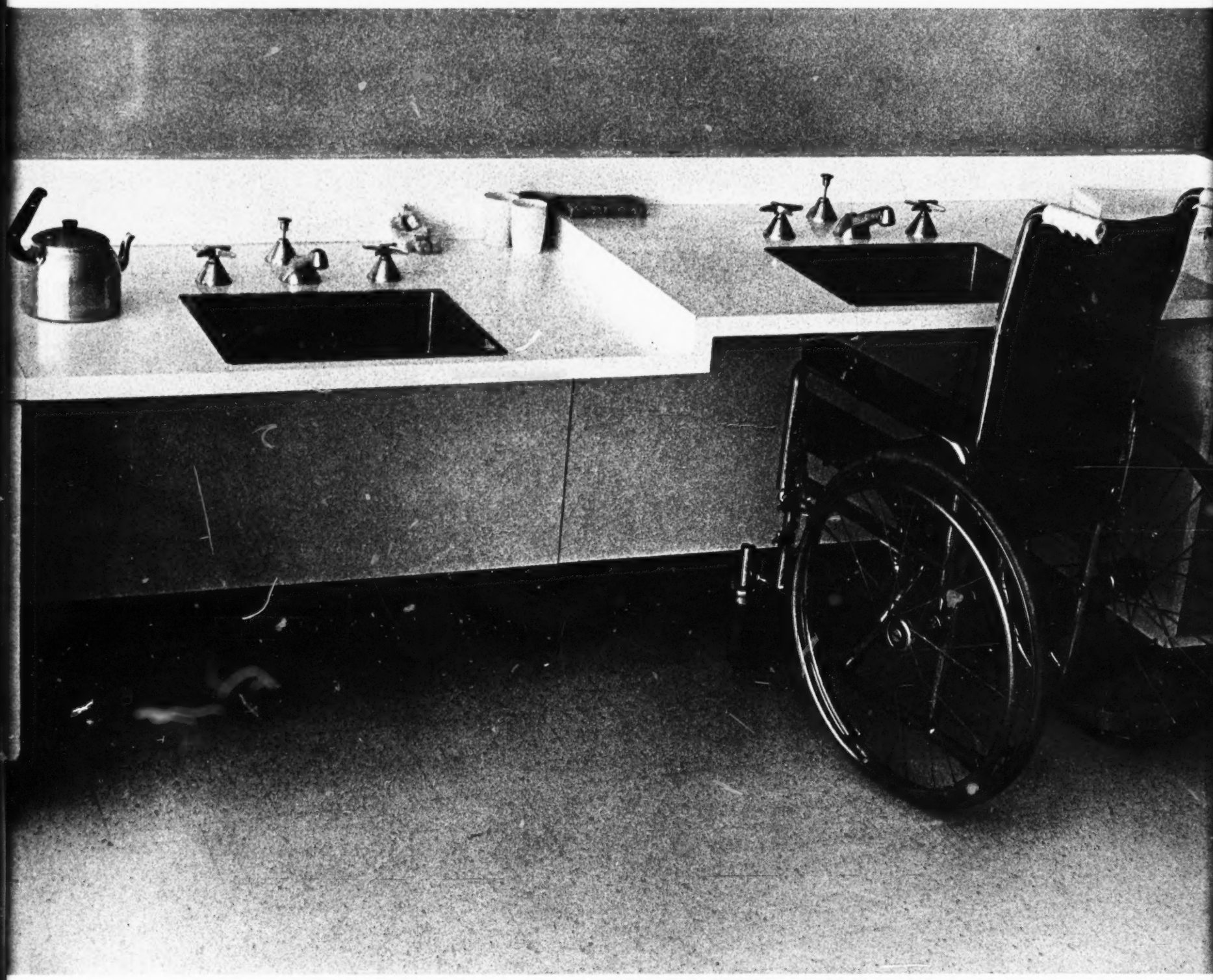


Figure 3

Sinks designed for two different wheelchair - heights, with sloped basin, recessed plumbing, controlled water pressure, and removable handles.

Figure 4

Playing and Working with Water.
Learning the properties of basic materials and feeling the power and control when transferring the materials to varied - sized containers.

3. The maximum pressure of the water emitted from the faucets was controlled by a gauge available only to the adults.

4. The sink handles which control the flow of water were removable. The teacher can assess whether the child involved can make an appropriate judgement.

5. The drain was designed to prevent a common occurance with all young children - overflow caused by the stuffing of a miscellaneous assortment of objects in the outlet.

6. The slope of the basin (to have all water flow away from the child) was graded from a shallow 1" in the area closest to the child's body and angled to a depth of 3" (a satisfactory depth for activities) at the most distant end.

The Observation Room (Figure 1)

The observation room was planned to serve several functions:

1. To afford our research investigators an opportunity to observe and record both the performance and the affective behavior of the children in a naturalistic setting.

2. To give parents a chance to observe their children at play, to make realistic judgments as to the quality of their child's work in contrast to other children and to see the methodology of the teacher in attempting to elicit maximal response from their child.

3. To allow visiting professionals an opportunity to observe this facility and its program without intruding upon the privacy of the students involved in the project.

4. To provide a setting for seminars and teacher-training for educators interested in becoming specialists in the field of the pre-school handicapped child.

With this multi-faceted group of objectives in mind, a design was projected for a shelf-like writing surface across the front wall of the observation room. This wall itself was constructed of one-way mirror glass. This plan gives the children in the schoolroom an attractive mirrored surface on the short wall diametrically across from the housekeeping wall unit. It simultaneously offers an accurate viewing window for observers.

Built into this formica faced writing table are the controls for a microphone system with six-zoned areas that can be tuned-in independently or together at the will of the visitor in the observation room. Installation is now complete for recording all the audio and visual activity within the Nursery School. Visual recording of the activity in the room is accomplished with two Concord television tape cameras suspended from the ceiling at either end of the 40' room. Remote control adjustment, focusing and monitoring is available both in the observation room for research investigators and in the office of the director. Instant replay of any sequence as well as storage of particularly pertinent tapes of interest is a by-product of such a T.V. tape system. The on-going program in the Learning Laboratory can be projected at will to groups assembled in the auditoriums of the research wing for lectures.

The Office (Figure 1)

The office was located in a position to enable the director to be in contact with both the schoolroom and the activity in the observation room. Parents can enter the office without being seen by their children. The wall facing the schoolroom was constructed of one-way mirror glass - an extension of the treatment used in the observation room. This arrangement was choosen:

1. To give the director an opportunity to have constant coverage of the classroom and its activity so that she could:
    a. make herself available when the staff needed to be supplemented.

b. be aware of any particular sequence of performance that would be appropriate for suggested recording for future clinical research or teacher training use.

2. To provide parents, in conference with the director in the office, with a visual interpretation while discussing the individual needs and capacities of their children.

3. To make available an extra area for observation when groups larger than 10 could not comfortably be accommodated in the observation room itself when visiting the Learning Laboratory.

The Decor of the Schoolroom

In addition to being a functional facilitating environment for children, this room was designed to be an attractive and inviting place in which to work. A sensitive balance had to be achieved. We did not want a spartan-like, sterile laboratory but we recognized at the same time that too rich a variation of color and design would interfere with the focus and concentration on the educational materials themselves (which are usually styled in vibrant primary colors).

The floor is covered with muted buff-beige vinyl. The walls are off-white as are the formica work surfaces. There are natural oak doors and woodwork. There is one accent of a rich yellow on the wall of the housekeeping units. On this wall, there was added a shelf configuration on which was placed a group of dishes and utensils carefully selected (with respect to color and shape) that are associated with the play in this particular area. This was the only completely decorative feature incorporated in the design of the pre-school room.

Equipment Design

The Circular Work Tables

The work tables were designed to provide:

1. The most comfortable physical setting for children to work *individually* with manipulative materials. (Figure 7)
2. A place where a *group of children* could be brought together – each comfortably but as part of a "class" – for group activities, educational games, the reading of stories, cooking experiences, and general socialization. (Figure 8)

Before establishing the optimal table shape and the most effective size, many factors had to be considered. There had to be sufficient room to allow each child to have the freedom to work independently with comfort and the ability to locate and reach all associated task materials. In the handicapped population, there is a higher frequency of immature and infantile behavior patterns than is found in normal youngsters in the same chronological age group. The tendency to make physical contact and take possession of other's materials decreases as maturity increases. With normal children, those who are free to move readily and readjust positions in space, delineation of play area need not be as sharply defined. The child can remove himself from an untenable location or relationship and readily establish a new work position at a different table or on the floor.

However, among our patients, few are free to ambulate and change position. In children with motor and/or behavioral dysfunction, this type of commonplace physical transferring requires uncommon effort and change of focus – enough to diminish the interest in the initial activity. Too often the depth of involvement of some of our children (particularly those whose disabilities are related to central nervous system problems) is markedly superficial. We are constantly attempting to deepen their emotional investment in their work. Arranging an effective environment - one with enough privacy for each child to be in control of his own materials

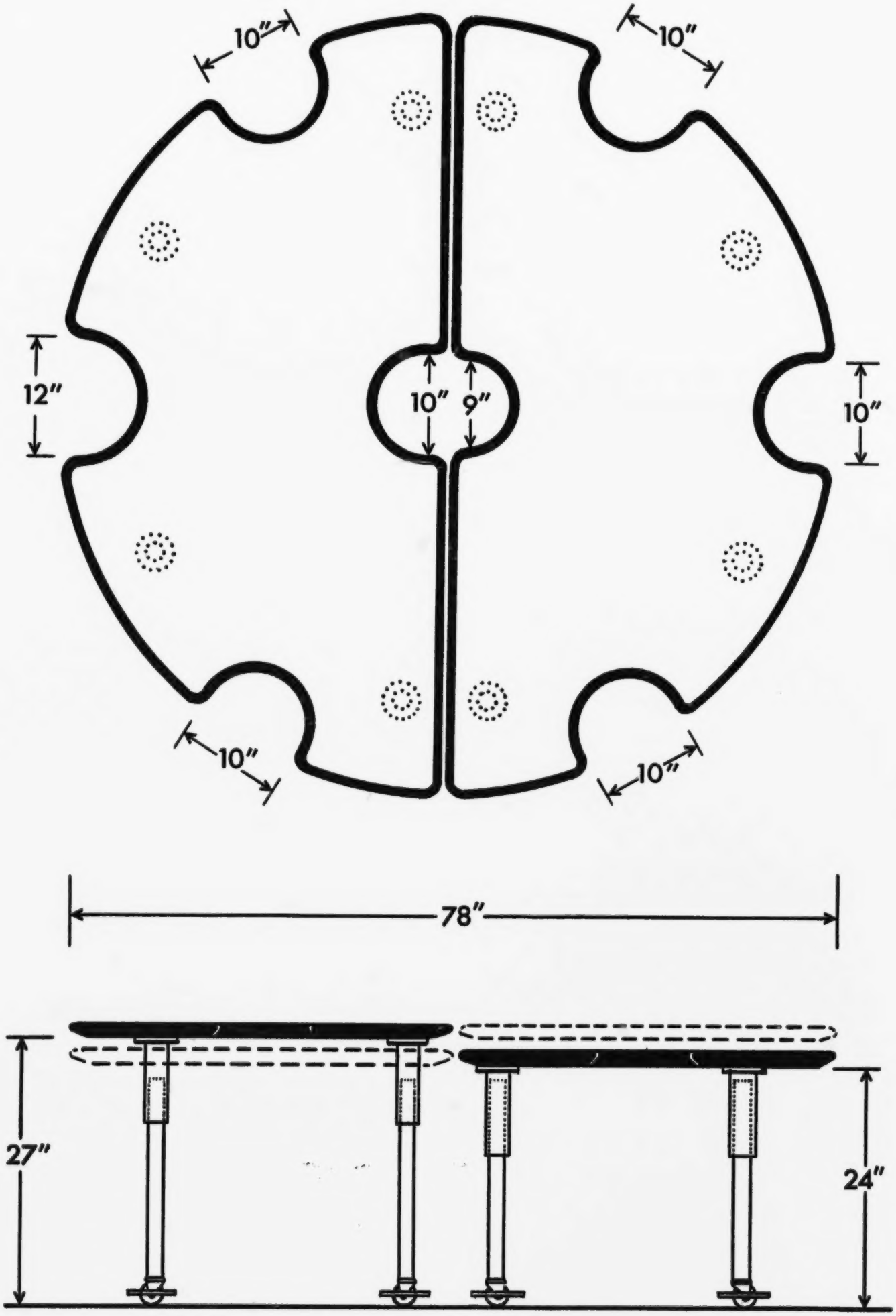


Figure 5

The Design of the Work Tables

Figure 6

Two semi-circular work tables with adjustable height and varied-sized insets for wheelchairs.

Figure 7

Playing and Working with manipulative - relationship materials. Learning to recognize the goals of a task, to identify similarities and differences, to differentiate color, size and shape variables and to organize an approach to a solution.

Figure 8

Playing and Working with friends.
Learning to share materials, to wait for one's turn, to respect another child's right to possess a desired object, to recognize the different capacities of one's peers and to assess one's own capabilities as a learner.

and yet available to interact with the other children - thus becomes more critical.

In our years of experience, with over 500 children, at least 75% have been in wheelchairs. The use of these chairs immediately suggested the cut-out design within the table. There are many practical explanation for this:

1. It affords the child with weak musculature a convenient and appropriate resting place for his arms while working.

2. It encircles the child's waist, and decreases the possibility of items falling off the table into the child's lap or on the floor.

3. It decreases dependency upon the adult as retrievers of lost parts.

4. It allows all the accessories that are associated with the child's project, at any one moment, to be in front of the child and hopefully within the child's vision and physical ability to organize them.

The dimensions of the cut-out are of importance if this encircling of the waist is to be effective when a child is in a wheelchair. In a systematic study of the young children on our service, we arrived at an average waist depth for the median-aged child in the pre-school program. We also had to allow for those children who were in wheelchairs - some with low bracing, others with high bracing including a knight-spinal. Our solution to these wide variations was to establish a majority of the seating positions for the average weight 3½-4 year old. And, we allocated one space each for the more unique under-sized and over-sized pre-schooler.

Our experience had substantiated our initial impression that six children in this type of a pre-school program formed an optimal working group for each working period. This size group, programed

at one time, allowed for and encouraged interaction. Yet, the group was small enough to allow a high ratio of teacher to child. In our planning then, we allowed for six wheelchair positions on the circumference of the work table.

The next variable to be considered was more difficult - the height of the tables. We had to satisfy a child who was walking and would use a conventional kindergarten chair and, simultaneously we had to meet the needs of the larger population in wheelchairs. The pre-school aged child is expected to use either a "tiny-tot" wheelchair or a "growing-child" wheelchair. We found, after measuring many wheelchairs, that there was no real standardized height for arm rests even in wheelchairs manufactured for this specialized age range. There was a variation of 3½ inches that had to be considered if the children were to be able to sit properly at a table - with their arms free to move in optimal working positions. Since our wheelchaired population constantly changes, the only obvious solution appeared to be a table that could be lowered and raised with a built-in differential adjustment in height.

The change in height had to be simple enough to be handled by one teacher - hopefully without too much effort or time. The adjustability was arranged with screw-type sockets that had a margin of a 4 inch differential on each leg. The legs can be contracted or elongated by clockwise and counter clockwise movement of the lower segment of the aluminum leg. Each leg can be rotated separately by a teacher until the proper balance is established. Ballbearing markers click into place at the end of each revolution.

The legs of the tables are mounted on casters with individual locks. The tables can be readily moved and then stabilized once the correct position has been established.

The circular table was planned as two distinct halves. We recognized that there would be times when one group of children would require a higher working space than another segment of the class. This flexibility could be accomplished with two semi-circles. There was another bonus in this design. It allowed us to build two extra seating areas in the center of the circular table. These work

tables could then be used as two independent units (with four children each or three children and a teacher at each portion). This versatility proved effective, during a recent 6 month period of time, when many of our children had hearing deficits as a sequela to maternal rubella. It was, in fact, imperative for the teacher to face the child to allow for the greatest possible degree of face and gesture contact.

The Sand and Water Table (Figures 9 & 10)

In designing the sand and water tables, many of the features of the work table, as planned and described previously, were incorporated. The table would have to be available to children in wheelchairs, children who work from a standing position and also children who use conventional pre-school chairs. Once again, the height would have to be adjustable to meet these requirements and the table free to move and yet to be locked in place.

The actual dimensions were determined by our intent to encourage more than one child to use these unstructured materials at the same time. (Figure 11) The table had to be wide enough to allow a cut-out at each end and long enough to give each child freedom to work independently at his particular location. There was one other consideration that went into our planning of dimension and structure. The population that we have serviced at the Institute includes a group of children with congenital anomolies that include deformity and/or absence of one or more limbs. The youngsters with phocomelic and amelic conditions in their upper extremities manipulate the sand and water with their feet and need a table sufficiently large and sturdy to support them in the table itself. (Figure 12)

The depths of both tables were determined by two factors:

1. They had to be deep enough to hold a sufficient quantity of sand and water to make these activities pleasurable and satisfying ones to the children.
2. They had to be shallow enough to allow for the child to be able to reach over the rim and into the sand or water with comfort and confidence.

At the same time, wheelchairs had to fit comfortably underneath the lower surface of each table. The availability of the media at the right height is critical for those children with above elbow

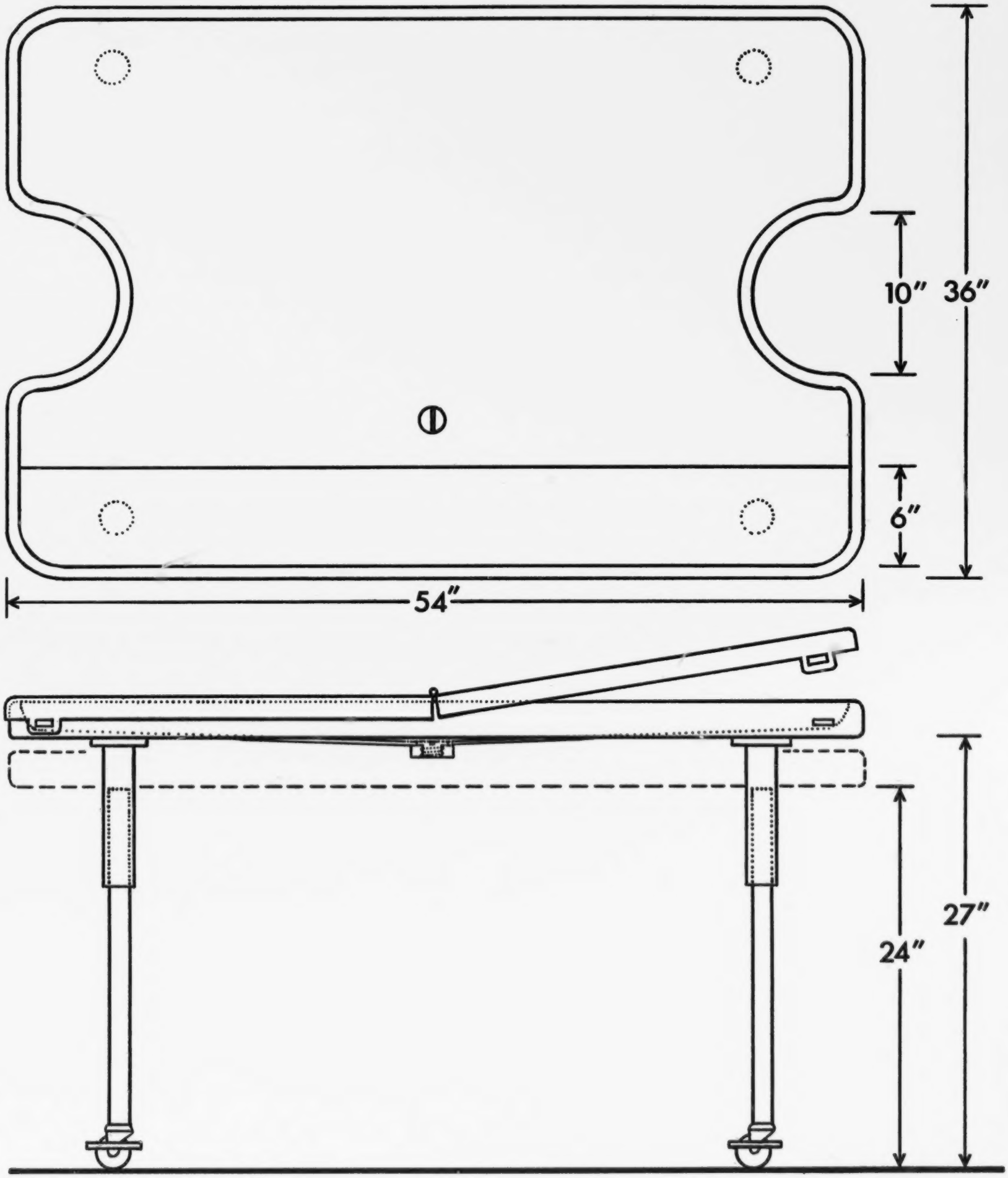


Figure 9

The Design of the Sand and Water Tables

Figure 10

The Sand and Water Tables with adjustable height, insets for wheelchairs, and ledge for accessories complementing the activity.

Figure 11

Playing and Working with Sand.
Learning the distinctive tactile and constructional characteristics of this elemental material as well as the gratification gained by making changes in position and form by using either hands or feet.

Figure 12

Playing and Working with Water.

Learning some of the specific characteristics of this element - that it supports flotation of particular materials, that levels can be changed, that liquids can be transferred by a variety of methods including siphoning.

amputations, who use foreshortened stumps for "feeling", as well as for those children who have limited vertical range of mobility.

Once again, to foster independence and to clarify the function of objects, those play materials that are used in conjunction with sand and water have to have a well-defined and accessible storage space. Our plan therefore included a raised shelf along one of the lengths of the table for placement and storage of the materials used to complement and extend the play of the child. This design with one cut-out at each end of the table allowed for choice of placement. A youngster whose right hand was more effective could be in a position at the table with the raised ledge to his right or a child whose left hand was more effective with the raised storage space to his left.

Metal covers for the tables were designed that could be folded for storage (with a hinged center fold) or could be locked into place over the table frame to create an additional work surface or limit the activities available to the children at a particular time.

The Carpentry Work Bench (Figures 13 & 14)

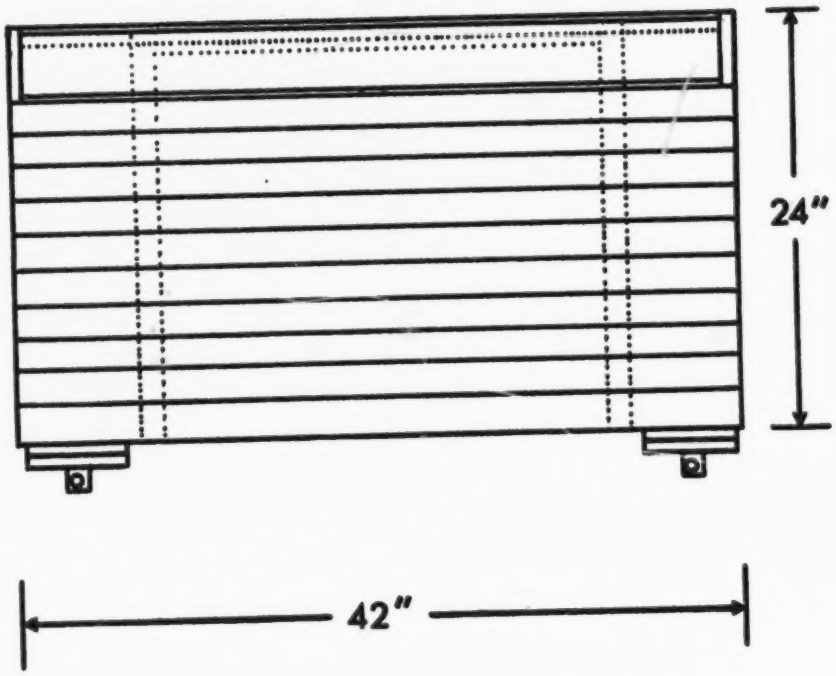
Our general concern with correct height for effective use of all furniture and equipment designed for this school was magnified when we planned the design of the work bench. Work with wood and carpentry tools requires leverage and strength. For the most part, the population of children served in the Institute have diminished power, stamina and coordination. To these problems must be added the problems of each child's particular musculo-skeletal deficiency. Those patients who are wheelchair bound, because of weakness or paralysis in their lower extremities, depend almost completely upon their upper trunks and arms for movement and thrust. Once again the height of the working surface is of great significance if the child is to be satisfied and successful at the task. (Figure 15)

Because of the unusual weight required for the wooden block used for the carpentry bench, the design of the legs had to be individualized for this piece of equipment and was different from the circular legs adopted in the pieces previously described. The design called for external rather than internal bracing to allow the wheelchairs to be completely inserted underneath the table-top. Traditional triangular construction would interfere with the placement of wheelchairs. Adjustability in height could not be dependent upon the screw design used in the other play and work tables. Heavy-duty rectangular legs, with extension pieces built within each leg, were called for. Variability in height was arranged by a series of notches and spring holding devices.

On a conventional carpentry bench there is one vise. This custom-designed carpentry bench has two: one for youngsters whose left hand is more effective and one for youngsters who are more facile with their right hand. For example, some of our children are hemi-paretic; others have unilateral amputations.

Since it was our intent to use real tools (of the lightest weight possible), it was clear to us that there had to be plans for storing

and locking them into the work bench itself. A vertical storage unit was constructed at the rear of the work surface with its own hinged cover that can be opened and closed only by keys held by the adult staff. Each carpentry tool has a unique position in the storage unit designated by a silhouette of the tool shape painted in red. This provides opportunity for size and shape discrimination and encourages the type of differentiation which we constantly reinforce as part of our education goals.



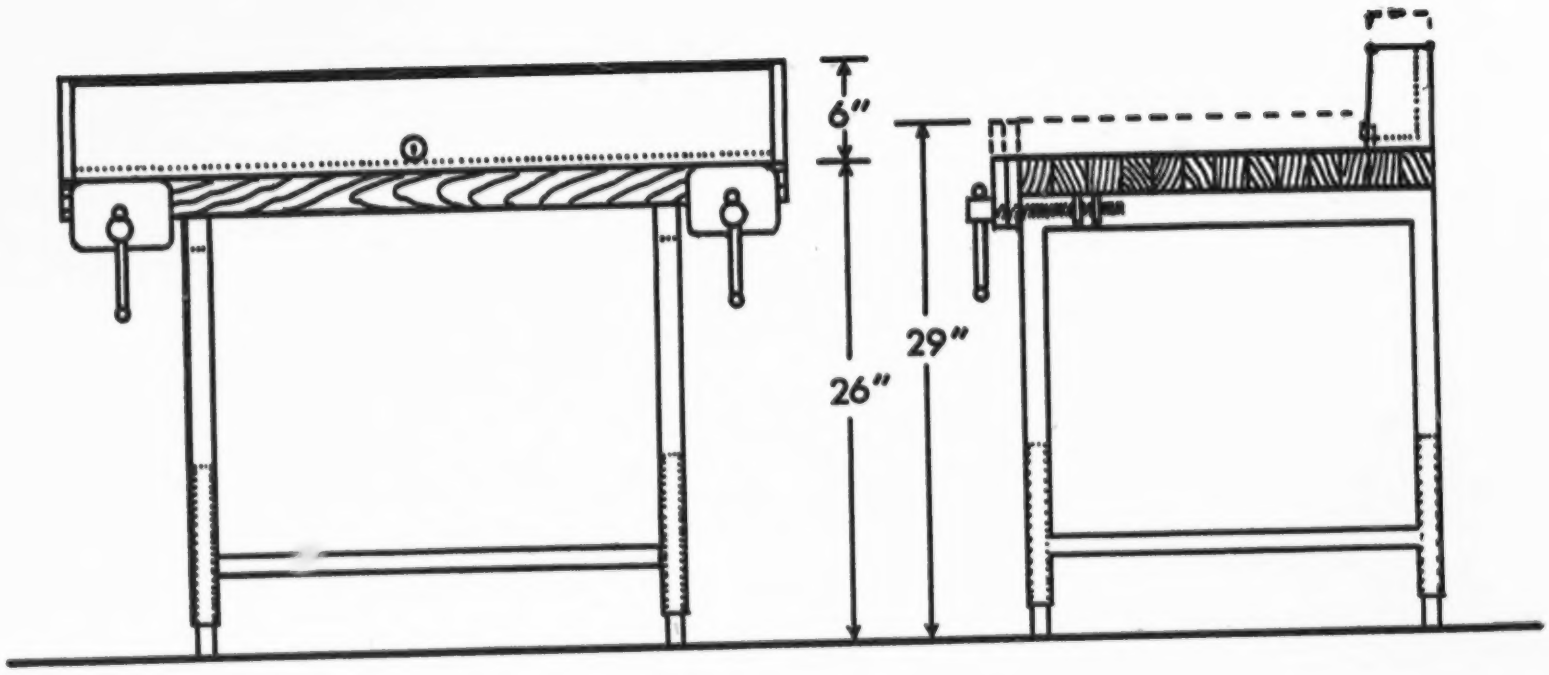


Figure 13

The Design of the Carpentry Bench

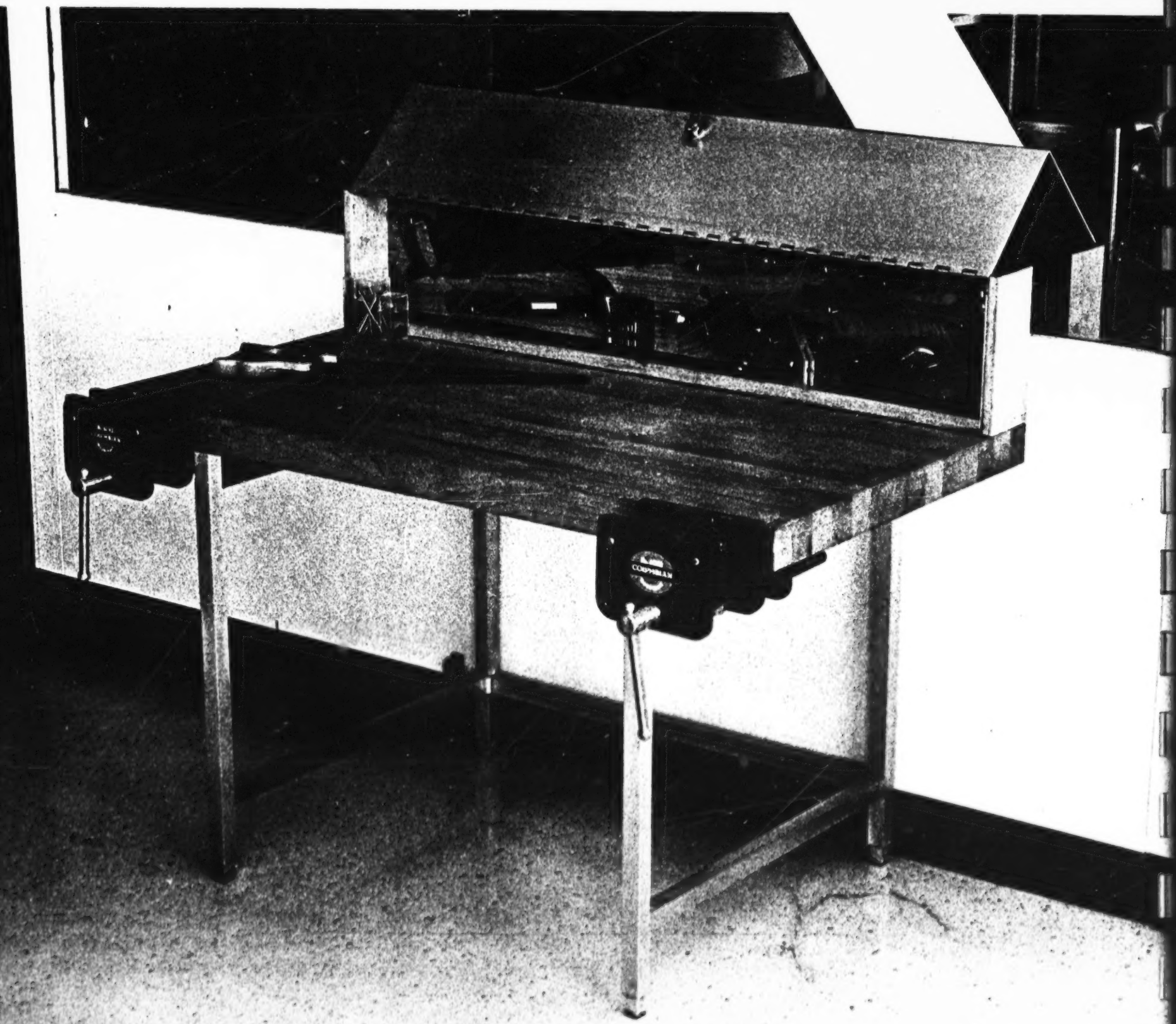


Figure 14

Carpentry bench with adjustable height for wheelchairs, two vises for preferential or intact hand and incorporated storage area for tools.

Figure 15

Playing and Working with wood and Carpentry tools.
Learning the specific properties of wood, the appropriate use of individual tools to perform functions and the satisfaction derived from the physical action involved while changing the form of objects by intent.

Design of the Easel (Figure 16)

Conventional easels are too narrowly based and too fixed in angulation to be effective with disabled children. We required an easel that had a wide range in height and angulation, and with adjustable paint trays. (Figures 17, 18, 19, 20) Movement on the vertical axis had to be unusually flexible to make the surface auspicious for:

1. The child who sits on the floor and paints with brush held in his toes. (Figures 21, 22)
2. The child of 2-5 years of age who stands and paints.
3. The child who uses a chair - with brush held in his mouth.
4. The child who uses either the "tiny-tot" or "growing" wheelchair.

Starting from a horizontal plane, we wanted a range of rotation of zero to 90 degrees. This would make the easel effective for painting objects on a flat tablelike surface. At the same time, children with motor limitations, due to paralysis or contractures, as well as those youngsters who use prosthetic devices, without wrist flexion, can all work at their optimal and appropriate angle.

The paint trays had to be accessible to children of either right or left handedness. In no way would a conventional commercial placement (where the paint tray is in front of an easel) be adequate for our population. Many of the children do not have the available range of mobility to work from this proximal position.

Another critical position was the location in height of the individual paint trays if we were to be successful in fostering independence. Our previous experience with both commercial easels (standing) and portable easels convinced us that only a design with a wide adjustability in height of the paints and brushes would

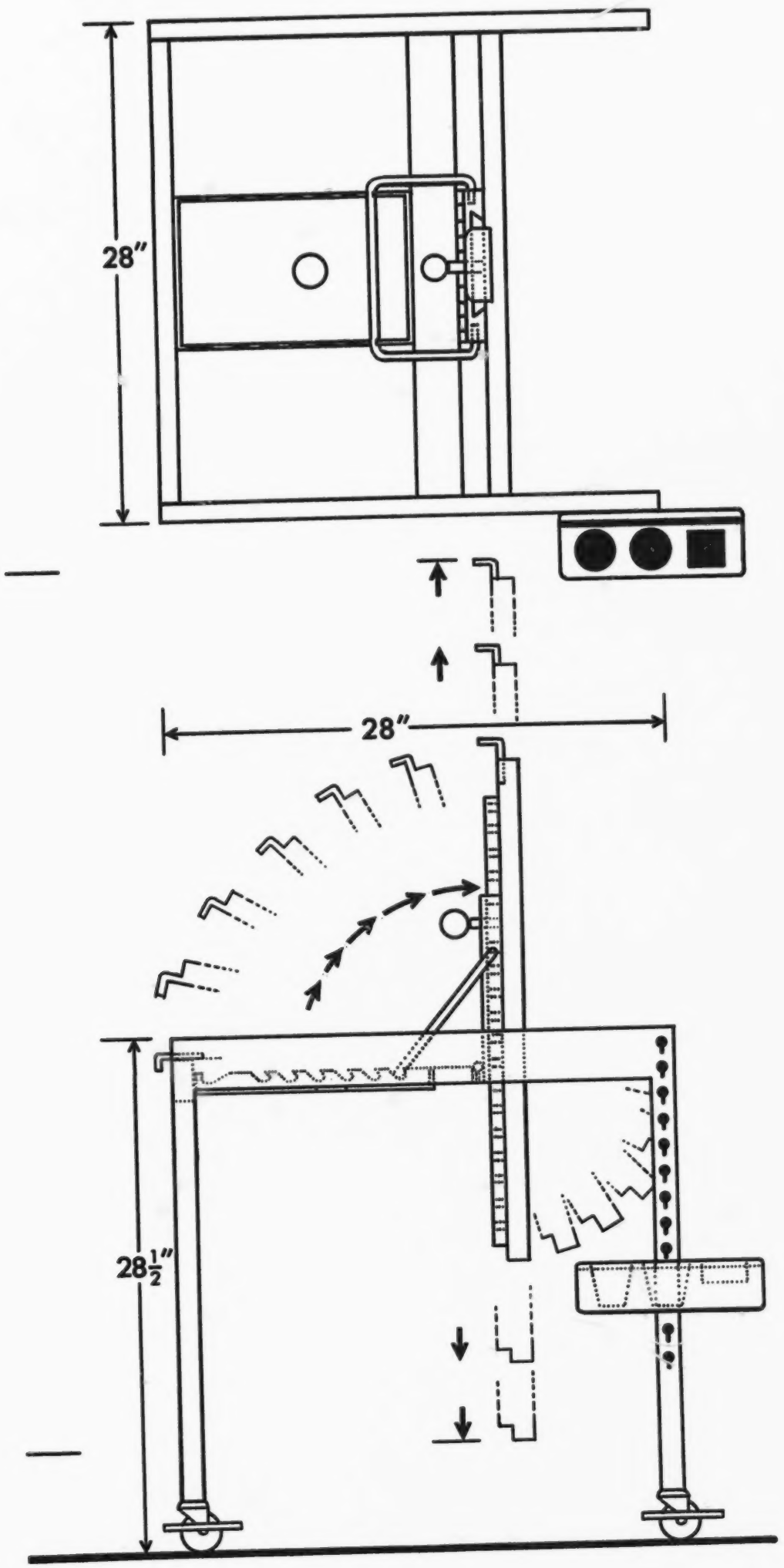


Figure 16

The Design of the Easel

Figure 17

The Easel in a horizontal position with paint trays that are adjustable in height and positioned on left or right side of painting surface.

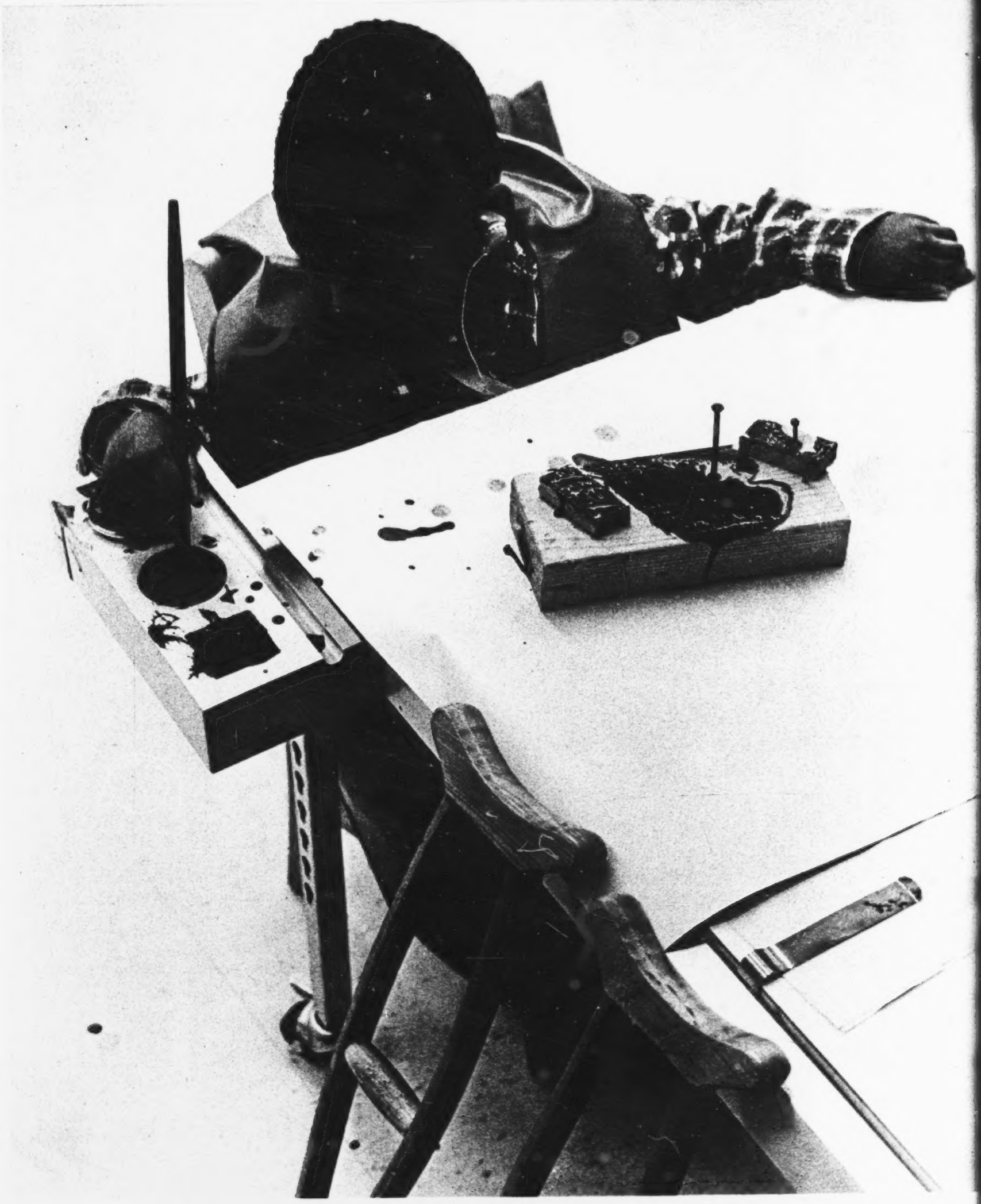


Figure 18

Playing and Working with paints.
Learning that liquid drips and dries, that two wet colors superimposed produce a third color, that different materials absorb paint at different rates.

Figure 19

The Easel in a selected position of angulation to maximize function when used by a wheelchair-bound child.

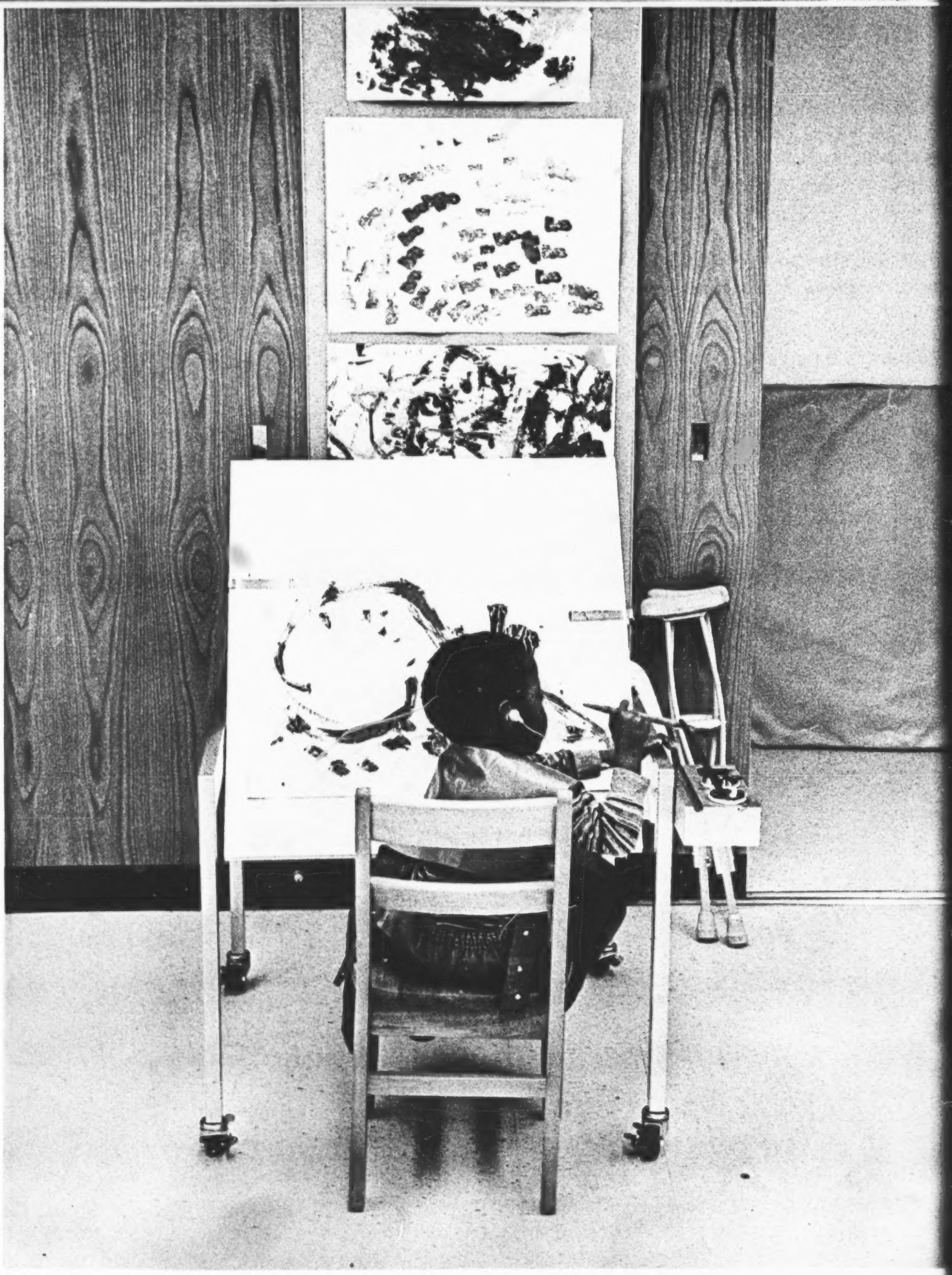


Figure 20

Playing and Working with paints.
Learning the different arm movements that are essential to make vertical and horizontal lines and dots and the muscle control that is required to put on paper the forms and contours that the child wishes to express.

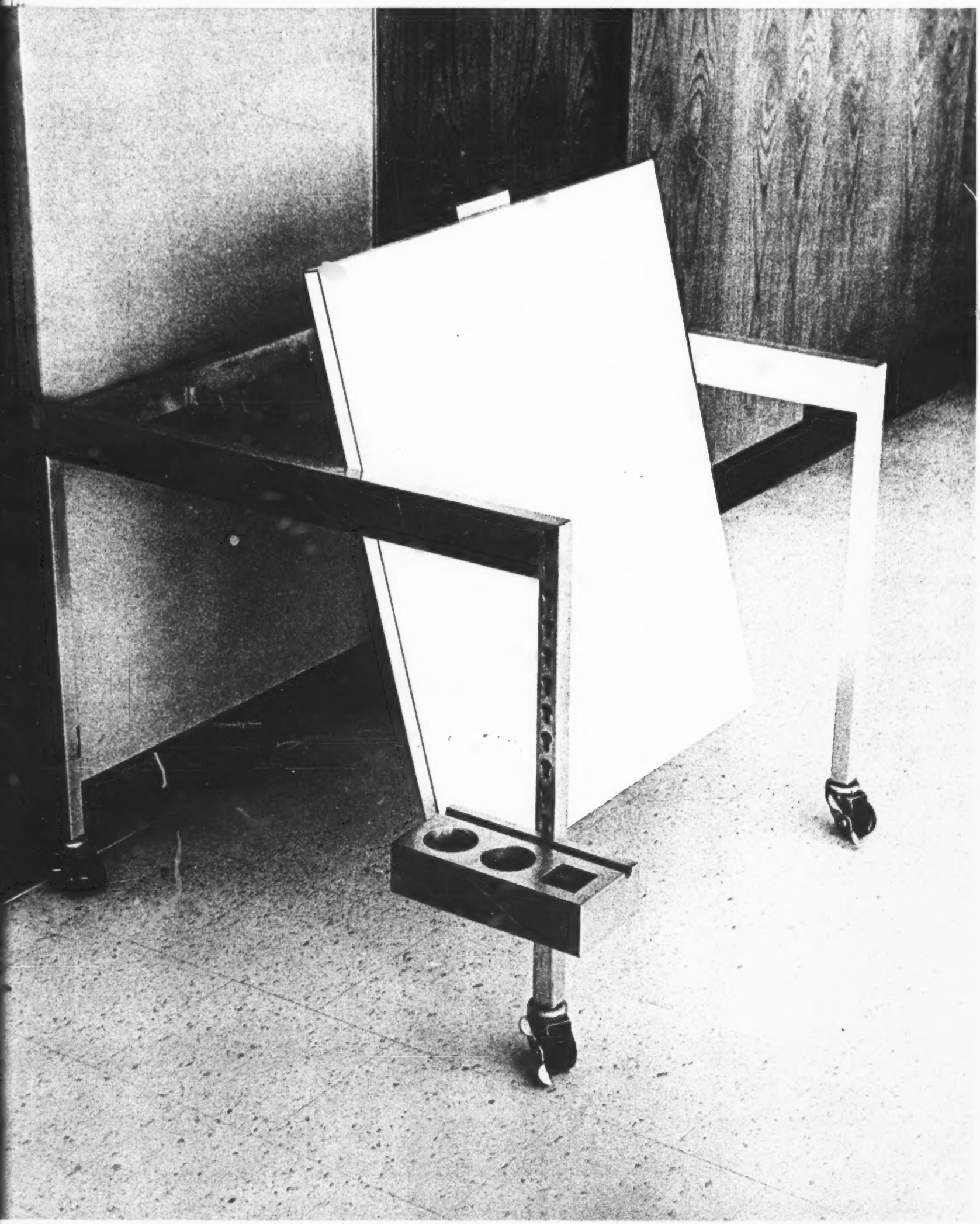


Figure 21

The Easel in a lowered position, available to armless children who paint with their feet using appropriate adjustment of paint tray.

Figure 22

Playing and Working with paints.
Learning that you can make a very personal impression with paint on paper. At three years of age, the process is intriguing; the product is secondary.

afford the kind of independent action we hoped to encourage in these very young children. This was accomplished by having a series of notches at distances of 1½ inches all along the right- and left-hand external face of the easel's front legs - with individual removable paint trays fitted with external hooking devices capable of being inserted into a series of notches at the appropriate height. Adjustment was then available for any child's particular pattern of handedness, arm movement, wrist rotation and flexion.

While designing this paint-tray with circular inserts for two different color paints, we included a square inset for water. Once again we were reinforcing our continuous goals to have the children make differentiation in basic shapes and forms wherever possible.

Adjustment of the paper itself on the easel to the lower, upper, right or left surface of the 26"x28" facing is important. It is facilitated by using draftsman clips. The child who can only reach lower corners, as well as the child whose motion is limited and can only reach one side of the paper for painting, can get satisfaction from this activity. We allowed for a large surface on which to paint to foster freedom of large movement - at least the optimal movement that can be possible for each patient. This was the basis for the overall extended size of the easel's surface as well as the use of only 24"x18" newsprint for this activity.

The Isolation Table (Figures 23 & 24)

There was a clear need for a piece of equipment at which a child could work individually or alone with a teacher in a tutorial approach. The rationale for this type of "isolation" is based upon a series of factors and judgements.

1. The need for a specialized area where the educator can work with one child on his very individualized learning deficits or can evaluate a child who has been newly admitted by offering a sequence of educational materials in an informal testing situation. (Figure 25)

2. The inability of a very immature youngster to integrate immediately into a group situation without anxiety.

3. The desirability of separating a disruptive and over-reacting youngster from the general work tables while simultaneously offering him an alternate and attractive work space to continue his play alone until he is able to marshall the type of control that is required in a larger group activity.

All the considerations with reference to height, to size of the inset to encircle the waist, to mobility of the unit, and to positioning by locks that were determinants affecting the design of the group work tables were applicable to this unit model. The overall area of the rectangular surface was kept small purposefully - to give a feeling of privacy and yet at the same time give adequate room for the materials that one youngster would need while working on a particular educational project.

This "quiet" area was further delineated by designing a mock tambour door - one that swings outward to create a partition-effect, adjacent to the placement of the isolation table.

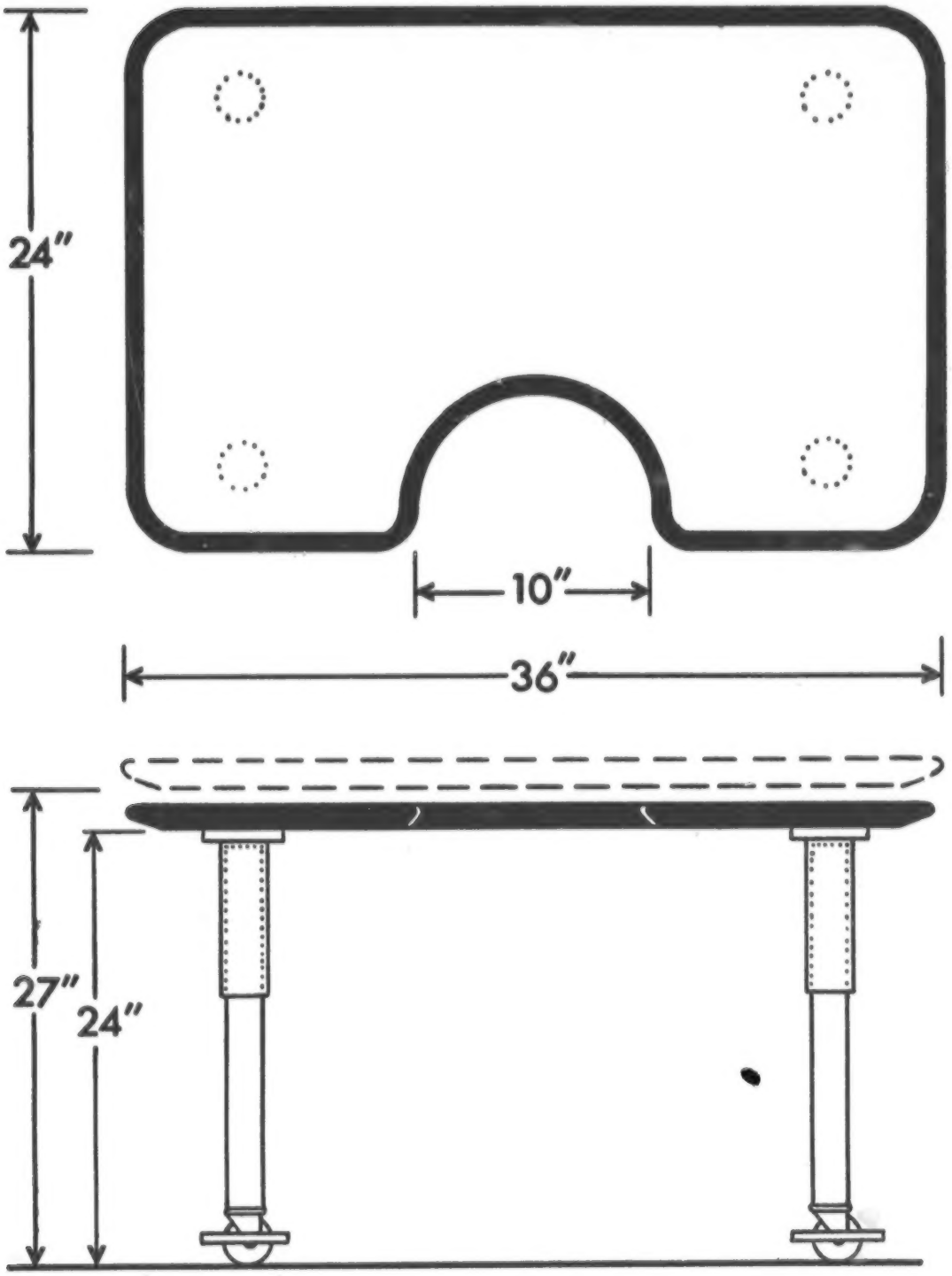


Figure 23

The Design of the Isolation Table

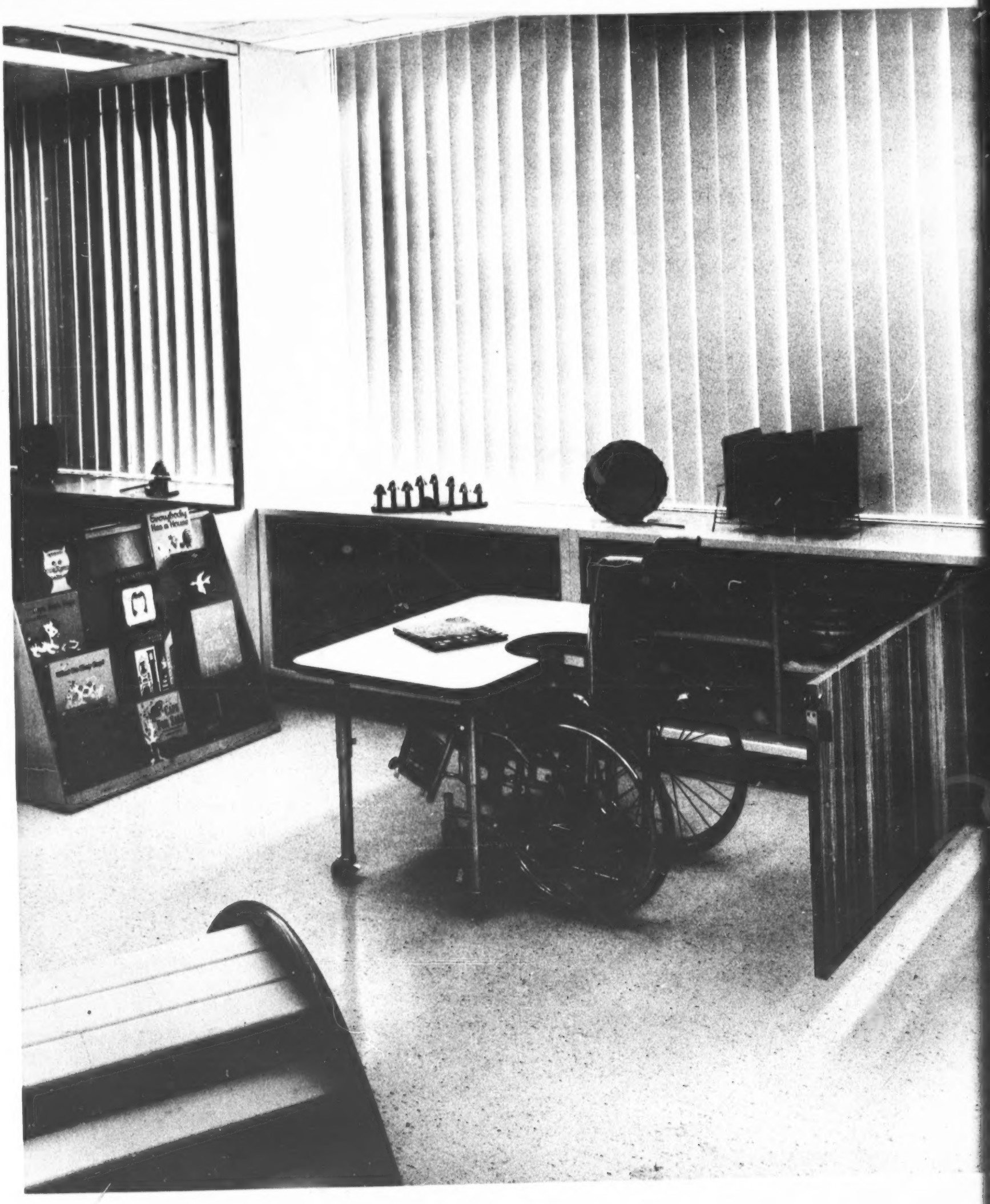


Figure 24

The isolation table with adjustable height for wheelchairs and proportioned area for individual work space.

Figure 25

Playing and Working with educational materials with the help of a teacher.
Learning that a teacher is available to clarify confusions, to assist in difficult tasks and can be trusted and caring and concerned with one's needs.

Conclusion

This monograph has been prepared with a specific intent - to describe the components of a specialized physical environment planned meticulously as an optimal facilitating setting for the education of multi-handicapped pre-school aged children. A propitious setting, if this refers to the plant itself, *is not enough.* It is but a shell - a container - without content. The quality of the content is directly determined by the quality of the personnel who implement the program. Well qualified and experienced pre-school educators, in a correct ratio of teacher to student, can be effective and innovative in unpropitious and disadvantageous settings. However, in such an environment, the teachers must accept the reality that much time will have to be spent away from the actual education of the child in order to make continuous adjustments in the physical environment - a constant manipulation of materials, furniture and accessories.

This custom-designed setting, with individually planned activity areas, would be attractive, but sterile, under the guidance of unqualified staff. The effectivness of the setting increases in direct proportion to the expertise and professional training of the people who translate the purposes for which it was designed. A minimal environment with maximal teaching can result in an effective, valid, and meaningful education experience. A maximal environment with minimal staff can produce little more than custodial care. A harmonious blending of the best of physical environments and a high quality and ratio of staff is the educational ideal for all children - and particularly for those children with unusual developmental problems. The greatest of effort is essential if we are to compensate and ameliorate their deficiencies.

Recognizing that our patients' development "has been hampered by life and circumstances," as has the development of the children involved in our current Head Start programs, we have to be concerned with the similar but not equal problem that Dr. Biber discussed when she questioned the programs for *the Disadvantaged* and the need "to protect against the establishment of programs constructed on too narrow a vision of growth needs and evaluative schema designed to test too restricted evidence of outcomes." (Biber, 1967) Our goals can be distorted if we regard

our population as *the Handicapped* or "separate children whose education needs are of an altogether different order from those of other children." (Biber, 1967) With this type of an equation, we could readily fall into a pattern of thinking and goal projection that would be focused only on the particular physical or sensory deficits of the child without giving awareness, respect and dignity to his assests.

The teacher of exceptional children has in common with his or her students an unusual share of problems. She must be able to recognize and identify the developmental profile of each child in her class, particularly the presence of cognitive dissonance. In this handicapped population, there is a wider range of differences than in a normal population. There are more reasons for differences than in normal groups. In addition to the highly publicized developmental lags that have been attributed to the cultural and socio-economic deprivation, there is a mosaic of behavioral and cognitive differences that, at least partially, result from organic disorders and lack of neurological integrity.

On the subject of rehabilitative medicine, Dr. Howard Rusk, the director of the Institute of Rehabilitation Medicine, stated many years ago, "In order to recognize pathologic gait, the examiner must be familiar with the mechanism of normal gait." (Rusk, 1964) This statement is so obvious and logical that it should not have had to be addressed to any professional discipline involved with the handicapped. Yet, it has to be restated here with reference to the developmental programs established for this population.

In order to recognize uncommon learning and behavior the teacher must be familiar with normal learning and behavior. After many years of experience, in an educative and evaluative role with this very diversified population of children bwtween the ages of 2-6, with their concommitant problems of physical, behavioral and/or mental deviation, it is our firm belief that the personnel responsible for pre-school developmental programs must be more than just "familiar" with normal children. They must have had a long internship in both theoretical and practical work with a normal early childhood population before assuming the deep responsibility for evaluating and educating handicapped children.

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NEW PUBLICATION DESCRIBES DESIGN
OF AN EDUCATIONAL LABORATORY FOR
MULTIHANDICAPPED PRESCHOOL-AGED CHILDREN

Gloria Zaludek
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For IMMEDIATE Release
(mailed: October 1, 1969)

With an optimal setting, severely handicapped children can learn to function at their highest potential. Ronnie Gordon has pioneered in developing an experimental nursery school designed to evaluate the youngsters' individual potentials and help them to develop intellectually, emotionally, socially and physically within the limits of their disabilities.

The developmental program and the floor plans of the physical layout of the classroom are presented in a new monograph entitled The Design of a Pre-School "Learning Laboratory" in a Rehabilitation Center (Rehabilitation Monograph XXXIX) recently published by the Institute of Rehabilitation Medicine, New York University Medical Center.

Written by Mrs. Gordon, director of the developmental program, this new monograph contains photographs of the children using specially designed educational equipment such as shallow sand and water tables adapted for wheelchair-bound children, and an adjustable easel that allows children without arms to paint with their feet. The learning laboratory, serving for the past seven years as an experimental classroom for children of nursery-school age, functions as an educational research laboratory in which staff observe, record and evaluate the children's behavior and parents learn how to work effectively with their own handicapped youngsters at home.

But the emphasis of the monograph is on the quality and ratio of the staff members, the educators who are most basic to implementing this program. Teachers must

(more)

first know the learning and behavioral patterns of normal children. Then they must understand the developmental problems associated with exceptional children before they can work effectively with them.

Copies of the monograph may be purchased for $3.00 each from the Publication Office, Institute of Rehabilitation Medicine, 400 East 34 Street, New York, N.Y., 10016. Checks should be made payable to New York University Medical Center.

# # #

Acknowledgements

To two indomitable women without whose spirit, integrity, support, respect for excellence, and above all, love and concern for children this pre-school developmental project would not have been conceived nor extended. To Miss Jessie Stanton and Mrs. Katherine Lilly Conroy this is not only an acknowledgement but a statement of profound gratitude and dedication.

Special recognition is warmly directed to Mr. Jack Dunbar, interior designer of Skidmore, Owings & Merrill, for an unusally sensitive interpretation of the needs of this population of children. This became more than a routine architectural assignment to Mr. Dunbar. His was both a perceptive and tender translation in architecture of the experience and expertise of the educator and the educational consultant, Miss Jessie Stanton.

Photographs were taken by Stanley Simmons and the New York University Photo Bureau.

Custom-designed equipment was constructed by Hudson Fixtures, Incorporated.

Line drawings by Christian H. Poole.